

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. 0837RF-H552-US

In Re Application of:
J. DONN HETHCOCK et al.

Serial No.: 10/533.427

Filed: 17 JANUARY 2006

**For: METHOD AND APPARATUS
FOR Z-DIRECTION
REINFORCEMENT OF
COMPOSITE LAMINATES**

Examiner: JEFF H. AFTERGUT

Confirmation No.: 5925

Art Unit: 1791

APPEAL BRIEF

Filed Via EFS-Web
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the Final Rejection dated 20 October 2008, finally rejecting 22-26 in the present Application. A Notice of Appeal was filed on 16 March 2009. Thus, the current due date for filing an Appeal Brief is 18 May 2009, as 16 May 2009 fell on a Saturday and 17 May 2009 fell on a Sunday.

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Payment of the \$540.00 fee for filing a brief in support of an appeal is being made concurrently via EFS-Web with the filing of this Appeal Brief. No other fees are deemed to be necessary; however, the undersigned hereby authorizes the Commissioner to charge any fees which may be required, or credit any overpayments, to Deposit Account No. **502806**.

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If no separate Petition for Extension of Time is filed herewith, this document is to be construed as also constituting a Petition for Extension of Time under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed. Any fee required for such Petition for Extension of Time and any other fee required by this document and not submitted herewith should be charged to Deposit Account No. **502806**. Any refund should be credited to Deposit Account No. **502806**.

Real Party in Interest (37 C.F.R. § 41.37(c)(1)(i)):

The real party in interest in the present Application is Bell Helicopter Textron, Inc., as indicated by an Assignment recorded on 16 February 2006, from the inventors to Bell Helicopter Textron, Inc., in the Assignment Records of the United States Patent and Trademark Office (the "PTO") at Reel 017181, Frame 0040.

Related Appeals and Interferences (37 C.F.R. § 41.37(c)(1)(ii)):

There are no related appeals or declared interferences that will directly affect or be directly affected by a decision by the Board of Patent Appeals and Interferences (the "Board") in the present appeal to the knowledge of the undersigned.

Status of Claims (37 C.F.R. § 41.37(c)(1)(iii)):

The present Application, which is an application filed on 29 April 2005 under 34 USC § 371 from International Patent Application Serial No. PCT/US2003/034946 claiming the benefit of U.S. Provisional Patent Application Serial No. 60/423,641, filed on 1 November 2002, was originally filed with 20 claims (*i.e.*, claims 22-28 and 32-44).

In a telephone conversation with Appellants' Representative, James E. Walton, on 10 March 2008, the Examiner indicated that the pending claims were the subject of a restriction requirement and Mr. Walton provisionally elected with traverse to prosecute the alleged invention of Group I (*i.e.*, claims 22-26). Appellants affirmed the election in their Response dated 20 August 2008. Thus, claim 27, 28, and 32-44 stand withdrawn from consideration.

In a Final Office Action dated 20 October 2008 ("Final Office Action"), the Office Action Summary indicates that claims 22-26 are finally rejected and that no claims are allowed or objected to.

The status of the claims is, therefore, believed to be as follows:

Allowed claims:	None
Claims objected to:	None
Claims rejected:	22-26
Claims withdrawn:	27, 28, and 32-44.

Appellant hereby appeals the Examiner's final rejection of the foregoing claims (*i.e.*, claims 22-26), which presently stand rejected over the cited references.Appealed claims 22-26 are set forth in a Claims Appendix, attached hereto, pursuant to 37 C.F.R. § 41.37(c)(1)(viii).

Status of Amendments (37 C.F.R. § 41.37(c)(1)(iv)):

Appellant filed no amendments subsequent to the Final Office Action.

Summary of Claimed Subject Matter (37 C.F.R. § 41.37(c)(1)(v)):

The independent claim involved in the present appeal relates, in general, to the reinforcement of composite laminates and composite laminate bonded joints. See Specification, p. 1, ll. 4-5.

Independent claim 22 relates to a method of bonding at least two composite preforms 141, 143 together. See Specification, p. 14, ll. 18-26, and Figure 13. The method includes providing at least two composite preforms 11, 141, 143, each composite preform 11, 141, 143 having composite fibers 21 extending generally in an X-Y plane. See Specification, p. 7, l. 21-25; p. 14, ll. 18-26; and Figures 1 and 13. Discrete fibers 25 are inserted through each preform 11, 141, 143 generally in a Z direction, so as to form exposed Z-direction fibers 31 and loops 33 (see Figure 1; exposed Z-direction fibers and loops are indicated as 147 in Figure 13), protruding outward from each preform 11, 141, 143. See Specification, p. 8, ll. 8-9, p. 8, ll. 14-17; and Figures 1 and 13. As best shown in Figure 13, exposed Z-direction fibers 31 and loops 33 (see Figure 1; exposed Z-direction fibers and loops are indicated as 147 in Figure 13) from one preform 141 (preform 11 in Figure 1) are overlapped with the exposed Z-direction fibers 31 and loops 33 (see Figure 1; exposed Z-direction fibers and loops are indicated as 147 in Figure 13) from another preform 143 (preform 11 in Figure 1). See Specification, p. 14, ll. 18-26, and Figure 13. A resin infusion material is infused (indicated by curve F) through each preform 141, 143, and the overlapped Z-direction fibers and loops 147. See Specification, p. 14, ll. 18-26; and Figure 13. The preforms 141, 143 are co-cured, thereby bonding the preforms 141, 143 together. See Specification, p. 14, ll. 18-26, and Figure 13.

Grounds of Rejection to be Reviewed on Appeal (37 C.F.R. § 41.37(c)(1)(vi)):

Issue No. 1. Claims 22, 23, and 26 stand rejected under 35 USC § 102(b), as being anticipated by U.S. Patent 4,888,228 to Sidles ("Sidles"). Thus, the issue is whether Sidles discloses every limitation of claims 22, 23, and 26 in the same relationship to one another as set forth in claims 22, 23, and 26.

Issue No. 2. Claims 22-26 stand rejected under 35 USC § 103(a), as being unpatentable over Sidles. Thus, the issue is whether the teachings of Sidles disclose or suggest all of the limitations of the claims as necessary for establishing a *prima facie* case of obviousness.

Argument (37 C.F.R. § 41.37(c)(1)(vii)):

I. **Issue No. 1 –**
Rejection Under 35 USC § 102(b) Over Sidles:

Claims 22, 23, and 26 stand rejected under 35 USC § 102(b), as being anticipated by Sidles. Appellants respectfully assert that the rejection is improper and should be reversed for the reasons set forth below.

It should be noted that the Office indicates that “[c]laims 22-26 are rejected under 35 USC § 102(b),”¹ but then states explicitly that “[i]t being noted here that the rejection of claim 24 is based solely upon obviousness (and not anticipation). The same is true for claim 25....”² The Final Office Action indicates that [c]laims 22-26 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sidles for the same reasons as expressed in paragraph 7 of the Office action dated March 20, 2008.³ Accordingly, claims 22, 23, and 26 stand rejected under 35 USC § 102(b) over Sidles.

An anticipating reference, by definition, must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim.⁴ Independent claim 22 requires “inserting discrete fibers through each preform generally in a Z direction, so as to form exposed Z-direction fibers and loops protruding outward from each preform.” The Office alleges that column 2, lines 20-24 teaches this limitation.⁵ *The portion of Sidles cited by the Office, however, does not disclose how the Z-direction fibers are placed in the substrate.* Sidles is silent with regard to how the fibers are placed in the substrate except in its discussion of a “double cantilever beam delamination test.” Sidles teaches that “[s]ix plies were prepared from an all glass substrate having **woven loops** on either side. Cut pile was formed on one side by **cutting the tips from the loops**”

¹ Final Office Action, Detailed Action, p. 2, I. 14.

² Office Action of 20 March 2008, Detailed Action, p.5, II. 4-5.

³ Final Office Action, Detailed Action, p. 2, II. 14-16.

⁴ *In re Bond*, 15 U.S.P.Q.2d (BNA) 1566, 1567 (Fed. Cir. 1990).

⁵ Office Action of 20 March 2008, Detailed Action, p. 3, II. 22-25. In the Final Office Action, the Office references this rejection at p. 2, II. 15-16.

(emphasis added).⁶ Thus, in Sidles' embodiments having loops on both sides of the substrate, the loops are formed from continuous strands of fibers that are woven through the substrate. Appellants respectfully assert that Sidles' continuous strands are not the discrete fibers inserted through a preform generally in a Z direction, as required by claim 22. In Sidles' embodiments having cut pile on one or both sides of the substrate, loops are first formed from continuous strands of fibers that are woven through the substrate. The loop tips are then cut from the loops to form the cut pile. Sidles' Z-direction fibers, even in these embodiments, are not discrete fibers inserted through a preform generally in a Z-direction, as required by claim 22. Therefore, Sidles cannot anticipate the present invention, as set forth in claim 22, because Sidles fails to disclose each and every limitation of the claimed invention in the same relationship as set forth in the claims.

Furthermore, independent claim 22 requires "infusing a resin material through each preform and the overlapped Z-direction fibers and loops." The Office, pointing to column 2, line 60, through column 3, line 4 of Sidles, alleges that "the reference taught than an organic binder was supplied to the preforms."⁷ Sidles teaches "an organic binder which is applied to one or both sides of the substrate. The first and second plies 15, 20 are stacked so that the binder 40 is dispersed between the plies."⁸ Claim 22 recites the phrase "infusing a resin material," which Appellants respectfully assert is a term of art. In Fundamentals of Composites Manufacturing: Materials, Methods and Applications;⁹

All of the resin infusion technologies share some common features. In all of them, dry (without resin) fiber preform is placed into a mold and the mold is closed. Resin is then injected into the mold so that the preform is fully wetted with resin.¹⁰

Applicant's Specification teaches:

In Figure 13, two preforms 141 and 143 are infused together to form a co-cured reinforced joint 145. In this example, each part 141 and 143 includes exposed Z-direction reinforcement fibers 147. The parts are

⁶ Sidles, col. 5, II. 6-8.

⁷ Office Action of 20 March 2008, Detailed Action, p. 4, I. 1.

⁸ Sidles, col. 2, II. 46-49.

⁹ A. Brent Strong, *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, Society of Manufacturing Engineers, 2007, pp. 417-418.

¹⁰ Strong, p. 417, left column, I. 28, through right column, I. 2.

placed together so that the Z-direction fibers co-mingle, and then resin is infused through both parts 141 and 143. A resin infusion path is shown as curve F

(emphasis added).¹¹

Appellants respectfully assert that one of ordinary skill in the art would understand that Sidles fails to teach "infusing a resin material through each preform and the overlapped Z-direction fibers and loops," as required by independent claim 22, as well as claims 23-26, which depend therefrom. As Sidles fails to disclose every limitation of claim 22 in the same relationship to one another as set forth in claim 22, Appellants respectfully assert that Sidles cannot anticipate the present invention, as set forth in claims 22-26.

In the Final Office Action, however, the Office disagrees with the composites industry's definition, relying instead upon a definition from a generalized, online dictionary, Dictionary.com.¹² Appellants respectfully maintain that the definition provided herein (and in Appellants' response to the Office Action of 20 March 2008) is proper and should be used when construing the claims.

The Court of Appeals for the Federal Circuit (CAFC) provides a proper framework in which to construe claim terms in *Phillips v. AWH Corp.*¹³ The Court states that "[b]ecause the patentee is required to 'define precisely what his invention is,'...it is 'unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms.'"¹⁴ However, "the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention."¹⁵ "The inquiry into how a person of ordinary skill in the art understands a claim term provides an objective baseline from which to begin claim interpretation."¹⁶ "Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the

¹¹ Specification, p. 14, ll. 18-23, and Figure 13 of the present Application.

¹² Attachment, dated 15 October 2008, to PTO-892 accompanying Office Action of 20 October 2008.

¹³ *Phillips v. AWH Corp.*, 03-1269, -1286 (Fed. Cir., July 12, 2005) (Fed. Cir. BBS).

¹⁴ *Phillips*, slip op. at 8, citing *White v. Dunbar*, 119 U.S. 47, 52 (1886).

¹⁵ *Phillips*, slip op. at 9, citing *Innova/Pure Water Inc. v. Safari Water Filtration Systems, Inc.*, 381 F.3d 1111 (Fed. Cir. 2004).

disputed term appears, but in the context of the entire patent, including the specification.¹⁷ "We cannot look at the ordinary meaning of the term...in a vacuum. Rather we must look at the ordinary meaning in the context of the written description and the prosecution history."¹⁸ "[C]laims 'must be read in view of the specification, of which they are a part.'¹⁹ "[T]he specification 'is always highly relevant to the claim construction analysis. Usually it is dispositive; it is the single best guide to the meaning of a disputed term.'²⁰ "[W]hile extrinsic evidence 'can shed useful light on the relevant art,' we have explained that it is 'less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'"²¹ "Dictionaries, by their nature, provide an expansive array of definitions. General dictionaries, in particular, strive to collect all uses of particular words, from the common to the obscure."²² "Indiscriminate reliance on definitions found in dictionaries can often produce absurd results...One need not arbitrarily pick and choose from the various accepted definitions of a word to decide which meaning was intended as the word is used in a given claim. The subject matter, the context, etc., will more often than not lead to the correct conclusion."²³

Appellants respectfully assert that the Office has misconstrued the phrase "infusing a resin material." The claimed invention is directed to, *inter alia*, composite laminates. Appellants have provided a definition shown in a well-known composites text. The Office, in error, instead relies upon a definition from a general dictionary. As discussed in *Phillips*, "[o]ne need not arbitrarily pick and choose from the various accepted definitions of a word to decide which meaning was intended as the word is used in a given claim. The subject matter, the context, etc., will more often than not

¹⁶ *Phillips*, slip op. at 9, citing *Innova*, 381 F.3d at 1116.

¹⁷ *Phillips*, slip op. at 10, citing *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1477 (Fed. Cir. 1998).

¹⁸ *Phillips*, slip op. at 10, citing *Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1319 (Fed. Cir. 2005).

¹⁹ *Phillips*, slip op. at 13, citing *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 978 (Fed. Cir. 1995) (*en banc*), aff'd, 517 U.S. 370 (1996).

²⁰ *Phillips*, slip op. at 13, citing *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996).

²¹ *Phillips*, slip op. at 18, citing *C. R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 862 (Fed. Cir. 2004), quoting *Vanderlande Indus. Nederland BV v. Int'l Trade Comm'n*, 366 F.3d 1311, 1318 (Fed. Cir. 2004).

²² *Phillips*, slip op. at 26.

²³ *Phillips*, slip op. at 26-27, citing *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1999), quoting *Liebscher v. Boothroyd*, 258 F.2d 948, 951 (CCPA 1958).

lead to the correct conclusion.”²⁴ The subject matter concerns composite laminates and the definition provided by Appellants concerns “resin infusion,” as it pertains to composite laminates. It is, therefore, respectfully requested that the Office construe the claims in light of the definition of “resin infusion” provided by Appellants over the general definition proffered by the Examiner. Sidles cannot anticipate the present invention, as set forth in claim 22, when the terms of claim 22 are properly construed.

Claims 23 and 26 depend from claim 22. Therefore, the remarks provided *supra* concerning claim 22 apply equally to claims 23 and 26.

Accordingly, it is respectfully requested that the rejection of claims 22, 23, and 26 under 35 USC § 102(b), as being anticipated by Sidles, be reversed.

II. Issue No. 2 –
Rejection Under 35 USC § 103(a) Over Sidles:

Claims 22-26 stand rejected under 35 USC § 103(a), as being unpatentable over Sidles. Appellant respectfully asserts that the rejection is improper and should be reversed for the reasons set forth below.

In the consideration and determination of obviousness under 35 U.S.C. 103, the four factual inquiries²⁵ used as a background for determining obviousness are (1) determining the scope and content of the prior art; (2) ascertaining the differences between the prior art and the claims in issue; (3) resolving the level of ordinary skill in the pertinent art; and (4) evaluating evidence of secondary considerations. In determining the differences between the prior art and the claims, the question under 35 USC § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.²⁶ A prior art reference must be considered in its entirety, *i.e.*, as a whole, including portions that would lead away from the

²⁴ *Phillips*, slip op. at 26-27, citing *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1999), quoting *Liebscher v. Boothroyd*, 258 F.2d 948, 951 (CCPA 1958).

²⁵ See *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966).

²⁶ MPEP 2141.02, citing *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983).

claimed invention.²⁷ The U.S. Supreme Court reinforces this principle in its decision in *KSR Int'l. Co. v. Teleflex, Inc.*,²⁸ stating that “when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious.”²⁹

It is legally insufficient to conclude that a claim is obvious “merely by demonstrating that each of its elements was, independently, known in the prior art.”³⁰ When the claimed invention is not a “predictable use of prior art elements according to their established functions,” the claimed invention cannot be found to be obvious.³¹ For example, when the elements of the claimed invention work together “in an unexpected and fruitful manner,” the claimed invention was not obvious to one skilled in the art at the time of the invention.³² Moreover, “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”³³ The Office must “identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.”³⁴ The Office must also make “explicit” this rationale of “the apparent reason to combine the known elements in the fashion claimed,” including a detailed explanation of “the effects of demands known to the design community or present in the marketplace” and “the background knowledge possessed by a person having ordinary skill in the art.”³⁵ Anything less than such an explicit analysis is insufficient to support a *prima facie* case of obviousness. Such an analysis must not “read into the prior art the teachings of the invention in issue” and must “guard against slipping into the use of hindsight.”³⁶

²⁷ MPEP 2141.02, citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

²⁸ *KSR Int'l. Co. v. Teleflex, Inc.*, 550 U.S. ____ (2007).

²⁹ *KSR*, slip op. at 12, citing *United States v. Adams*, 383 U.S. 39, 40 (1966).

³⁰ *KSR*, slip op. at 14.

³¹ *KSR*, slip op. at 13.

³² *KSR*, slip op. at 12.

³³ *KSR*, slip op. at 14, citing *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006).

³⁴ *KSR*, slip op. at 15.

³⁵ *KSR*, slip op. at 14.

³⁶ *KSR*, slip op. at 17.

As discussed *supra* concerning the 102(b) rejection over Sidles, Sidles fails to disclose “inserting discrete fibers through each preform generally in a Z direction, so as to form exposed Z-direction fibers and loops protruding outward from each preform,” as required by independent claim 22. Furthermore, independent claim 22 is not obvious in light of Sidles, for example:

- The claimed invention is not made up of prior art elements combined according to known methods to yield predictable results. The cited art fails to teach “inserting discrete fibers through each preform generally in a Z direction, so as to form exposed Z-direction fibers and loops protruding outward from each preform;”
- The claimed invention is not a simple substitution of one known element for another that provides predictable results. The cited art fails to teach “inserting discrete fibers through each preform generally in a Z direction, so as to form exposed Z-direction fibers and loops protruding outward from each preform;”
- The claimed invention is not a use of a known technique to improve similar methods. The cited art fails to teach the claimed technique;
- The claimed invention is not an application of a known technique to a known method ready for improvement to yield predictable results. The cited art fails to teach the claimed technique;
- The claimed invention is not a result of choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success. The cited art fails to teach the claimed solution and provides no suggestion that such a modification would have any reasonable expectation of success;
- The claimed invention is not an application of known work in one field of endeavor used based on design incentives or market forces, wherein the variations are predictable to one of ordinary skill in the art. The cited art fails to teach the claimed technique; and

- The cited art fails to provide any teaching, suggestion, or motivation to one of ordinary skill in the art to modify Sidles commensurate with the claimed invention. The cited art fails to teach or in any way suggest the claimed technique.

Therefore, for at least these reasons, Sidles fails to render the present invention, as set forth in claim 22, obvious.

Furthermore, as discussed *supra* concerning the 102(b) rejection over Sidles, Sidles fails to disclose “infusing a resin material through each preform and the overlapped Z-direction fibers and loops,” as required by independent claim 22, as well as claims 23-26, which depend therefrom. The Office has provided no allegations concerning this limitation of the rejected claims, other than to allege that Sidles teaches the limitation. Concerning the claimed requirement that “infusing a resin material through each preform and the overlapped Z-direction fibers and loops,” Appellants respectfully submit that this claimed feature is not obvious in light of Sidles, for example:

- The claimed invention is not made up of prior art elements combined according to known methods to yield predictable results. The cited art fails to teach “infusing a resin material through each preform and the overlapped Z-direction fibers and loops;”
- The claimed invention is not a simple substitution of one known element for another that provides predictable results. The cited art fails to teach “infusing a resin material through each preform and the overlapped Z-direction fibers and loops;”
- The claimed invention is not a use of a known technique to improve similar methods. The cited art fails to teach the claimed technique;
- The claimed invention is not an application of a known technique to a known method ready for improvement to yield predictable results. The cited art fails to teach the claimed technique;

- The claimed invention is not a result of choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success. The cited art fails to teach the claimed solution and provides no suggestion that such a modification would have any reasonable expectation of success;
- The claimed invention is not an application of known work in one field of endeavor used based on design incentives or market forces, wherein the variations are predictable to one of ordinary skill in the art. The cited art fails to teach the claimed technique; and
- The cited art fails to provide any teaching, suggestion, or motivation to one of ordinary skill in the art to modify Sidles commensurate with the claimed invention. The cited art fails to teach or in any way suggest the claimed technique.

Accordingly, no reasoned explanation exists that one of ordinary skill in the art at the time of the invention would have found Appellants' invention, as set forth in claim 22, obvious in light of Sidles. Appellants, therefore, respectfully assert that Sidles fails to render obvious the present invention, as set forth in claim 22. Claims 23-26 depend from claim 22. The remarks provided herein concerning claim 22, therefore, apply equally to claims 23-26.

It is, therefore, respectfully requested that the rejection of claims 22-26 under 35 USC § 103(a), as being unpatentable over Sidles, be reversed.

CONCLUSION:

In view of the foregoing, Appellant respectfully requests the Board of Patent Appeals and Interferences to reverse the Examiner's rejections as to all of the appealed claims.

Respectfully submitted,

18 May 2009
Date

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ATTORNEY AND AGENTS FOR APPELLANTS

Claims Appendix
(37 C.F.R. § 41.37(c)(1)(viii))

Claim 22 (Original): A method of bonding at least two composite preforms together comprising the steps of:

providing at least two composite preforms, each composite preform having composite fibers extending generally in an X-Y plane;

inserting discrete fibers through each preform generally in a Z direction, so as to form exposed Z-direction fibers and loops protruding outward from each preform;

overlapping the exposed Z-direction fibers and loops from one preform with the exposed Z-direction fibers and loops from another preform;

infusing a resin material through each preform and the overlapped Z-direction fibers and loops;

co-curing the preforms, thereby bonding the preforms together.

Claim 23 (Original): The method according to claim 22, wherein the discrete fibers are fiberglass.

Claim 24 (Original): The method according to claim 23, wherein the fiberglass discrete fibers are S-glass discrete fibers.

Claim 25 (Original): The method according to claim 22, wherein the discrete fibers are graphite.

Claim 26 (Original): The method according to claim 22, wherein the discrete fibers are polymers.

Evidence Appendix
(37 C.F.R. § 41.37(c)(1)(ix))

1. A. Brent Strong, *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, Society of Manufacturing Engineers, 2007, pp. 417-418, entered into the record in Appellant's Response to Office Action of 20 March 2008, dated 20 August 2008.

Fundamentals of

Composites Manufacturing

Resin Infusion Technologies

CHAPTER OVERVIEW

This chapter examines the following concepts:

- Process overview
- Resin infusion technologies
- Equipment and process parameters
- Preform technology for infusion
- Resin characteristics
- Core and flow media materials
- Part design for resin infusion
- Centrifugal casting

PROCESS OVERVIEW

Besides being the best known of the many **resin infusion technologies** for making composite parts, **resin transfer molding (RTM)** is often the general term used for all resin infusion processes. However, in this text, RTM is used in a more narrow sense and "resin infusion" is the more general term. Another phrase occasionally used to describe the resin infusion processes is **liquid molding processes**. (Consult the "Liquid Molding" video, SME 2005 for a look at the equipment and techniques of liquid molding processes. These videos are excellent supplements to lectures and laboratories.)

All of the resin infusion technologies share some common features. In all of them the dry (without resin) fiber preform is placed into a mold and the mold is closed. Resin is then

injected into the mold so that the preform is fully wetted with resin. The resin is cured, the mold is opened, and the part is extracted. The basic resin infusion process is illustrated in Figure 16-1.

The advantages of the resin infusion processes, listed in Table 16-1, are immediately apparent. The factors especially appealing in the current composite world are: the better quality possible with resin infusion (good tolerances that are repeatable and excellent surfaces out of the mold); lower emissions; low labor requirements; low requirements for auxiliary equipment (like freezers and autoclaves); and the degree of design flexibility in both part size and complexity. Cycle times depend on the resin system used but typically fall in the range of 5–10 minutes. However, they can be as high as 2–8 hours for large parts like railroad cars and yachts. Inserts can be easily molded in and this means that one-piece, co-cured parts are often easy to make, thus reducing the total number of parts in an assembly.

An important advantage of the process that might not be obvious at first thought is the feature of being able to place continuous fibers (that is, continuous across the part) into the mold and then carrying out the molding operation without moving the fibers. This means that resin infusion can be used to make advanced composite parts where the direction of the fibers is critical to part performance. In addition, the ability to use low-cost materials and the speed

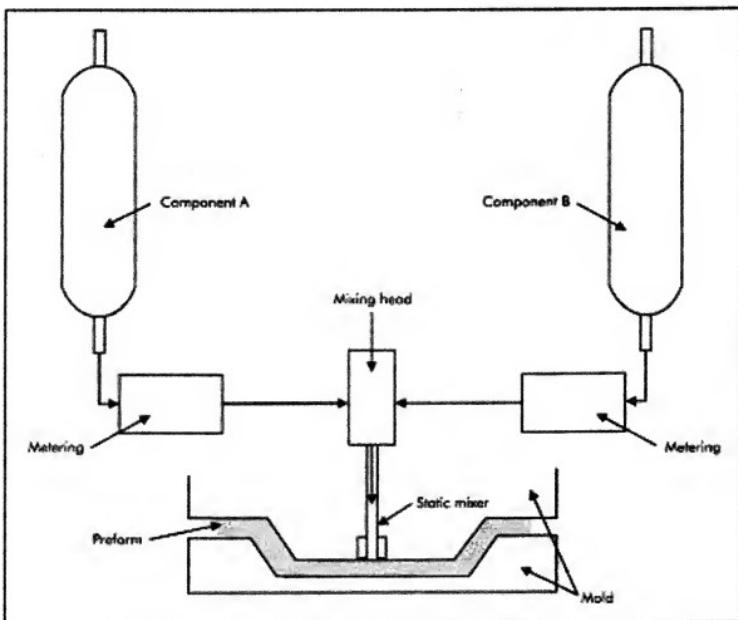


Figure 16-1. Basic resin infusion process.

of manufacture allow resin infusion to be used for engineering composites.

In engineering composites, resin infusion surpasses BMC and at least equals SMC in mechanical performance. This is because the fibers do not need to move in the mold. The operational costs of resin infusion are about equivalent to BMC and SMC but the material is slightly higher because it is difficult to add fillers. (They are sometimes separated from the resin as the resin/filler mixture infiltrates through the fiber pre-

form.) However, other costs such as the reduction in auxiliary equipment needed and the environmental aspects of resin infusion often result in it being the lowest-cost molding process. Hence, the process is likely to be important across the entire spectrum of composites manufacturing. The use of infusion processes is growing rapidly for both new parts and those that were previously made by other composites processes.

The disadvantages of resin infusion processes, also listed in Table 16-1, are not

Related Proceedings Appendix

(37 C.F.R. § 41.37(c)(1)(x))

There are no related appeals or declared interferences that will directly affect or be directly affected by a decision by the Board of Patent Appeals and Interferences (the "Board") in the present appeal to the knowledge of Appellants' representative.